

AMENDMENT UNDER 37 C.F.R. § 1.111
Application Serial No. 10/502,402
Attorney Docket No. Q82699

REMARKS

Claims 1-2 are all the claims pending in the application. Upon entry of the present Amendment, claims 1 and 2 are amended. Further, the specification is amended for purposes of clarifying the disclosure. No new matter is presented.

To summarize the Office Action, claims 1 and 2 are rejected under 35 U.S.C. § 102(b) as being anticipated by Bianchi (U.S. Patent No. 6,237,901), and claims 1 and 2 are rejected under 35 U.S.C. § 102(b) as being anticipated by Nishiyama et al. (U.S. Patent No. 4,886,256, hereinafter “Nishiyama”). The outstanding rejections are addressed below.

Claim Rejections - 35 U.S.C. § 102(b)

A. Bianchi

As noted above, claims 1 and 2 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Bianchi. This ground of rejection is traversed.

Applicant submits that Bianchi fails to teach or suggest all the limitations of the claimed coil spring of closed-end type, which is characterized in that a coupler is fixedly mounted between an outer peripheral surface of a terminal convolution of a coil element rod of the coil spring of closed-end type, the terminal convolution being partially flattened in cross section through a flattening process. Further, claim 1 defines an outer peripheral surface of a subsequent convolution subsequent to the terminal convolution of the coil spring of closed-end type, so that the coupler is brought into close contact with the outer peripheral surface of each of said terminal convolution and the subsequent convolution of the coil spring of closed-end type, whereby an

amount of initial deflection of the coil spring of closed-end type is decreased. Thus, the claimed coil spring provides for decreasing the initial deflection inherent in the coil spring.

In order to facilitate better understanding, the initial deflection will be discussed with reference to the “Reference drawings”, which are attached as an Appendix to the present Amendment.

In the Reference drawings:

Fig. K1 is a load-deflection diagram of the coil springs of various types, illustrating the properties of these coil springs;

Fig. K2 is a spring constant-deflection diagram of the coil springs;

Fig. K3 is a side view of one of the coil springs; and

Fig. K4 is a view taken along the line X-X of Fig. K3.

As shown in the Reference drawing “Fig. K3”, the coil spring of the closed-end type (hereinafter referred to as the closed spring) is provided with a normal-coil pitch portion N in its intermediate portion, which portion N is called “effective convolution portion N”. The effective convolution portion N of the closed spring has each of its opposite end portions M decreased in pitch, so that each of terminal portions of the coil element rod of the closed spring is brought in contact with a surface “A” of the coil element rod of a first convolution of the closed spring.

In the closed spring having the above construction, when the spring is disposed in free position, as shown in Figs. K3 and K4, the terminal portion “A” of the coil element rod in the spring is brought into contact with a coil element rod point “B1” in the first convolution of the spring. It is difficult for a compression coil spring to have its entire portion formed with the

same pitch in convolutions. Due to this, in general, the closed spring has its portion A-N (ranging from the terminal portion “A” to the effective convolution portion N) continuously varied in pitch starting from a pitch angle “0” up to the normal pitch angle appearing in the effective convolution portion N. A portion of the spring ranging from the terminal portion “A” to the first convolution is called “coil end”. Since the compression coil spring has the above-mentioned construction, when a load is imposed on the closed spring, convolutions in the vicinity of the coil end of the closed spring are gradually brought into contact with each other. For example, as shown in Fig. K4, the contact point between the adjacent ones of the convolutions gradually moves from the coil element rod point “B1” to “B2” and further to “B3”, which gradually decreases the number of the effective convolutions of the closed spring.

As a result, the spring constant reaches a predetermined value after the load reaches a predetermined value. In other words, the initial deflection of the closed spring occurs before the load reaches such a predetermined value.

Conversely, in a coil spring of closed-end type as defined by claims 1 and 2, as shown in Figs. 1 and 2 of present application, the coupler 3 is mounted in the vicinity of the front end portion of the coil element rod to provide a clearance between the surface of the terminal portion of the coil element rod and the corresponding surface of the first convolution of the coil element rod in the position “B1”. Due to the provision of such a clearance in the closed spring, the contact point “B1” remains unchanged in position even when the closed spring is subjected to the load. In other words, the contact point “B1” does not move to any other point “B2” or “B3”. As a result, the number of the effective convolutions of the closed spring does not decrease to

keep the spring constant of the closed spring at the predetermined value, which means that any initial deflection of the closed spring does not occur after the load imposed on the closed spring reaches the predetermined value.

As described above, it is not an object of the coupler of the claimed coil spring of a closed-end type to fix the terminal portion of the closed spring to a predetermined fixed position. Rather, the object of the coupler of the claimed coil spring resides in providing a clearance between the surface of the terminal portion of the coil element rod and the corresponding surface of the first convolution of the coil element rod, which clearance results in decreasing the initial deflection of the closed spring.

Notwithstanding the Examiner's rejection, Applicant submits that Bianchi fails to teach all the features of claim 1. For instance, Bianchi teaches a "suspension for a vehicle wheel using at least one helicoidal spring, and at least one flexible retaining and connecting armoring, which in working position, stresses a portion of the spring by maintaining it compressed, to obtain two different stiffness curves". *See* Bianchi at col. 11, lines 5-15. More specifically, with respect to Bianchi's first embodiment (shown in Fig. 1), Bianchi teaches a helicoidal spring 2. As for this spring 2, Bianchi describes in its column 5, lines 59-60 as follows: "the distance separating the various windings is not constant.". In other words, Bianchi's spring 2 comprises at least a pair of widely-spaced convolutions and a pair of narrowly-spaced convolutions. As is clear from Fig. 1 of Bianchi, the widely-spaced convolutions form a lower portion of the spring 2, while the narrowly-spaced convolutions form an upper portion of the spring 2. In operation, when the spring 2 is compressed, the lower portion of the spring 2 is first deflected, and then the upper

portion of the spring 2 begins to deflect, which produces a two-step load-deflection curve. When the spring 2 expands, it is considered that the armoring 3 restricts the spring's expansion so as to prevent occurrence of spring surge and resonance, whereby the armoring 3 functions as a shock absorber.

However, with reference to the Reference drawing Fig. K1, this will be described as follows: namely, the load-deflection curve disclosed in Bianchi forms a two-step curve comprising a "C1-C2" curve portion and a "C2-C3" curve portion, wherein a "0-C1" curve portion will be described later. As is clear from the Reference drawing Fig. K2, the spring constant of the coil spring varies at each of points C1, C2.

As for the difference in construction between the claimed coil spring and Bianchi, Applicant notes that Bianchi's spring is characterized by its two-step spring constant. As for Bianchi's spring 2, as is clear from the positions of securement elements (i.e., correspond to the couplers) 4, 6 shown in Bianchi's Fig. 1, the spring 2 is of a closed end type, but provided with unflattened terminal portions. Each of the securement elements 4, 6 merely covers both the unflattened terminal portion and a first convolution of the spring 2 to fix them together. It is an object of the securement element (4, 6) of Bianchi to fix the unflattened terminal portion and the first convolution of the spring 2 together so as to not permit them to be separated from each other when the spring 2 is subjected to an expansion shock in operation, whereby the armoring 3 of the spring 2 serves as a shock absorber. In other words, Bianchi fails to notice the presence of the problem (i.e., initial deflection) inherent in a coil spring of a closed end type provided with flattened terminal portions (see the reference numeral 2a in Fig. 1 of the present application).

By contrast, the coupler 3 of the claimed coil spring is provided between the terminal portion of the spring 1 and the first convolution of the spring 1 so as to prevent them from being brought into contact when the spring 1 is compressed, whereby the initial deflection of the spring is decreased. Moreover, claim 1 requires that the terminal convolution is partially flattened in cross section through a flattening process.

Conversely, Bianchi permits the terminal portion of its spring 2 to be brought into contact with a first convolution of the spring 2. Under such circumstances, it is not possible for Bianchi's spring 2 to prevent a contact point between adjacent ones of convolutions of the spring 2 from moving to produce a so-called "initial deflection" when the spring is compressed in operation, as is already described with reference to the Reference drawing Fig. K4 in the above.

As is clear from the above discussion, Bianchi's spring 2 suffers from the initial deflection problem. More specifically, as shown in the Reference drawings Figs. K1 and K2, the load-deflection curve C of the Bianchi's spring 2, the spring 2 suffers from the initial deflection "0-C1". After passing the initial deflection stage, the Bianchi's spring 2 enters its two-step spring constant stage, in which the spring 2 takes two spring constants C1, C2.

As for the conventional closed-end type coil spring, the conventional spring also suffers from its own initial deflection "0-B1", as is clear from a diagram B in each of the Reference drawings Figs. K1 and K2. Although the Bianchi's spring 2 is considered to be slightly decreased in its initial deflection somehow relative to the conventional spring, the Bianchi's spring 2 still suffers from a considerable amount of its initial deflection "0-C1".

In contrast with this, the initial deflection “0-A1” of the coil spring according to an exemplary embodiment of the present invention, which appears in a load-deflection diagram in the Reference drawings Figs. K1 and K2, is drastically decreased in comparison with that “0-B1” of the conventional coil spring of the closed end type. As a result, though the coil spring of the present invention is of the closed-end type, it is possible for the coil spring of the present invention to enjoy substantially the same straight load-deflection curve D, which is inherent in the open-end type coil spring.

In other words, Bianchi’s spring is not effective to decrease the initial deflection of the coil spring. Therefore, at least for the reasons discussed above, Bianchi does not disclose or suggest all the features of the claims coil spring.

Further, Applicant notes that Bianchi fails to teach or suggest the features of claim 2. For instance, Bianchi’s armoring 3 is made of an elastic material; and, the material is deflected together with the coil spring 2 and therefore considerably poor in stiffness relative to the coupler 3 of the present invention. On the other hand, the coupler 3 of the present invention may be made of, for example, aluminum and like high-rigidity materials capable of resisting against any deformation occurring at a time when the coil spring is deformed in operation. Thus, Bianchi fails to suggest a coupler made of an elastic material being larger in stiffness than the coil spring, as claimed.

In view of the foregoing, Applicant submits that Bianchi fails to teach or suggest all the limitations of claims 1 and 2. Accordingly, reconsideration and withdrawal of this ground of rejection is requested.

B. Nishiyama

With respect to the rejection of claims 1 and 2 as allegedly being anticipated by Nishiyama, Applicant traverses this ground of rejection.

Nishiyama likewise fails to teach or suggest all the features of independent claim 1. For instance, Nishiyama teaches a technical idea for substantially completely embedding a coil spring in a foam resin so as to prevent the spring's corrosion caused by mud splashed during travel and also to prevent the spring's surging vibration, wherein the foam resin comprises a soft flexible synthetic resin open-cell foam having surge-proof means and including waterproof means. Nishiyama's coil spring (body) 34 is of a closed-end type (see Fig. 4). However, when compressed, the coil spring 34 of Nishiyama produces its initial deflection. Such initial deflection is previously removed from the coil spring 34 according to Nishiyama when mounted in a shock absorber (i.e., suspension device 38 shown in Fig. 4) in a condition in which the coil spring 34 is preliminarily loaded before installation. Due to the presence of such preliminary loading operation of the coil spring 34, Nishiyama does not suggest removing the initial deflection of the coil spring by means of a static device, such as, a "coupler fixedly mounted" as claimed, without the preliminary loading operation which requires a considerable reduction of the coil spring in height in installation.

More specifically, as is in the case of Nishiyama, it is possible to remove the initial deflection through the preliminary loading operation of the coil spring. This is discussed in Specification of the present application at page 2, lines 20-23. However, in the case where it is not possible to apply such preliminary loading operation to the coil spring, Nishiyama does not

AMENDMENT UNDER 37 C.F.R. § 1.111
Application Serial No. 10/502,402
Attorney Docket No. Q82699

teach that “an amount of initial deflection of the coil spring of closed-end type is decreased” in the manner claimed.

Further, Applicant notes that in column 7, lines 17-19 of Nishiyama, Nishiyama discloses that Nishiyama’s coil spring is substantially free from any change in spring constant in operation. However, Nishiyama’s coil spring is preliminary loaded in removing its initial deflection at the expense of a considerable reduction in spring’s height in installation. In other words, Nishiyama fails to note the presence of the initial deflection of the coil spring in operation, and therefore fails to find out an effective solution in solving the initial deflection problem of the coil spring in the case where the preliminary loading operation is not applicable to the coil spring.

Thus, Nishiyama likewise fails to teach or suggest all the features of claim 1. Accordingly, reconsideration and withdrawal of the rejection of claim 1 is requested. Claim 2 is believed to be allowable at least by virtue of depending from claim 1, and allowance of claims 1 and 2 are therefore requested.

In addition, Applicant submits that Nishiyama fails to teach all the limitations of claim 2. For instance, Applicant notes that it is necessary for the foam resin of Nishiyama to readily deflect together with the coil spring in operation. Therefore, it is clear that the foam resin is very poor in stiffness. In this respect, Applicant notes that claim 2 of the present application requires that the coupler of the claimed coil spring is made of an elastic material “being larger in stiffness than said coil spring”. Nishiyama’s foam resin structure clearly fails to suggest this feature.

AMENDMENT UNDER 37 C.F.R. § 1.111
Application Serial No. 10/502,402
Attorney Docket No. Q82699

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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